Age Estimation by Telomeric Length Using Human (*Homo sapiens*) and Domestic Cat (*Felis catus*) Epidermis, Bone and Cartilage Samples was Found to be Ineffective

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ABSTRACT

Age estimation using telomere length is an alternative tool that could facilitate the casework in forensic investigations. Although blood can be used in the measurement of telomere length in order to estimate chronological age and/or biological age, the use of blood does present certain potential limitations such as the possibility of infection, the influence of medication, chemicals or the level of stress a subject might have been exposed to, all of which can

contribute to fluctuations in telomere length. In this study, tissue samples of the epidermis, bone, and cartilage were collected from human cadavers (Homo sapiens, n=80) and those of domestic cats (Felis catus, n=30) for telomere shortening assessment. The relative telomere length (RTL) was assessed by real-time PCR to estimate the age of the collected specimens ranking between 16- to 95- or 1- to 9-year old human or domestic cat cadavers, respectively. As a result, there was no significant correlation between telomere shortening and age recorded in the bone and cartilage, yet a small positive relationship between age and telomere shortening was observed in the human epidermis with R^2 = 0.0276 (p = 0.0095) and in the epidermis samples obtained from female domestic cats with R^2 = 0.1373 (p = 0.0171). Taken together, these results suggest that the determination of telomere length using real-time PCR obtained from human epidermis, bone, and cartilage samples may not be applicable for determination of an estimation of age in human and domestic cat specimens.

Keywords: Age, Bone, Cartilage, Skin, Telomere, Senescence

INTRODUCTION

The aging process, or senescence, is related to progressive and irreversible cellular changes that seem to function as a molecular clock. Most somatic cells have the capability of a limited number of divisions, which is the main cause for cell senescence (Allsopp et al., 1992; Blasco, 2005). One theory for this is that this cellular senescence is caused by a gradual decrease in the telomere length (Harley et al., 1990; Epel et al., 2004; Monaghan and Haussmann, 2006). Telomeres are comprised of repeating nucleotides (TTAGGG) that are located at the end of a chromosome. They play an important role in maintaining chromosome integrity which may be affected by deterioration or damage (Blackburn, 1991; Shay and Wright, 2000; Takasaki et al., 2003) Telomere length shortening occurs normally in most somatic cells during DNA replication throughout the lifespan of living organisms (McEachern et al., 2000; Cawthon, 2002; McKevitt et al., 2002; Haussmann et al., 2003; Vleck et al., 2003; Callicott and Womack, 2006; Hewakapuge et al., 2008; Izzo et al., 2011). Presently, telomere length has been widely used to estimate age in human subjects (Hewakapuge et al., 2008; Karlsson et al., 2008) and for several other mammalian species such as mice (Callicott and Womack, 2006), dogs (Nasir et al., 2001; McKevitt et al., 2002; Fick et al., 2012; Buddhachat et al., 2017), sea lions (Izzo et al., 2011) and elephants (Buddhachat et al., 2017). However, when the outcomes from several studies were compared, a degree of inconsistency was observed among the various subjects. Therefore, the correlations between telomere length and age could only be validated in some studies (Haussmann et al., 2003; Vleck et al., 2003),while the results were inconclusive in some other